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IN THE

Supreme Court of the United States

OCTOBER TERM, [redacted] 1970

No. [redacted] 139

JACK ST. CLAIR KILBY, *Petitioner*

v.

ROBERT N. NOYCE, *Respondent*

PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS

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INDEX

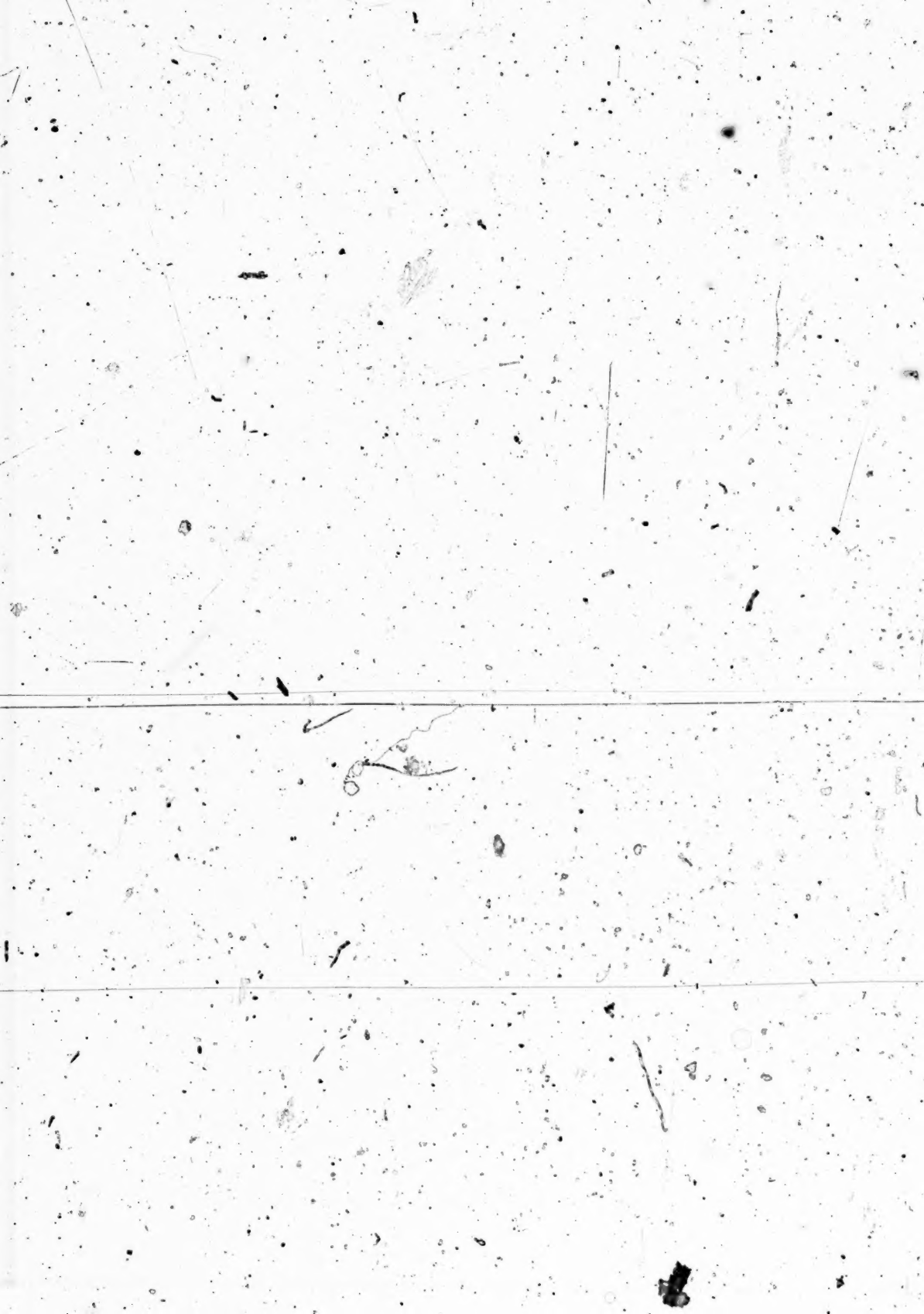
	Page
Opinions Below	2
Jurisdiction	2
Questions Presented	2
Statutory Provisions Involved	3
Statement of the Case	5
Reasons for Granting the Writ	9
1. The Court should resolve a conflict between federal appellate courts as to the standards by which decisions of the Patent Office Board of Patent Interferences are to be reviewed	9
2. The Court would have the first occasion since the adoption of the Patent Act of 1952 to pass upon the important federal question of how the U.S. Court of Customs and Patent Appeals is to review decisions of the Patent Office in *inter partes* cases	13
3. The Court should correct the decision of the court below which conflicts with applicable decisions of this Court	16
Conclusion	16
Appendix A Statutory Provisions	1a
B Opinion and Judgment of the Court of Customs and Patent Appeals	4a
C Judgment of the Court of Customs and Patent Appeals on Rehearing	19a
D Opinion of the Board of Patent Interferences of February 24, 1967	20a
E Portion of the Decision of the Patent Office Primary Examiner of December 13, 1963	33a

CITATIONS

Cases: Page

Brenner v. Manson, 383 U.S. 519 (1966) 2, 10, 15, 16
Carnegie Steel Co. v. Cambria Iron Co., 185 U.S. 403 (1902) 15
Ditto, Inc. v. Minnesota Mining & Mfg. Co., 336 F. 2d 67 (8th Cir. 1964) 14
Gandy v. Marble, 122 U.S. 432 (1887) 13
General Motors Corp. v. R.E. Dietz Co., 420 F. 2d 1303 (D.C. Cir. 1969) 11
Gold v. Newton, 254 Fed. 824 (2d Cir. 1918) 12
Graham v. John Deere Co., 383 U.S. 1 (1966) 13n
Graver Tank & Mfg. Co. v. Linde Air Products Co., 336 U.S. 271 (1949) 14
Great A&P Tea Co. v. Supermarket Equipment Corp., 340 U.S. 147 (1950) 14
Heston v. Kuhlke, 179 F. 2d 222 (6th Cir. 1950) ... 11
Hoover v. Coe, 325 U.S. 79 (1945) 10n, 13
Jiffy Enterprises, Inc. v. Sears, Roebuck & Co., 306 F. 2d 240 (3d Cir. 1962), *cert. denied*, 371 U.S. 922 (1962) 14
Maytag Corp. v. Murray Corp., 318 F. 2d 79 (6th Cir. 1963) 14
Minnesota Mining & Mfg. Co. v. Carborundum Corp., 155 F. 2d 746 (3d Cir. 1946) 11
Morgan v. Daniels, 153 U.S. 120 (1894) 2, 9, 10, 11, 13, 16
National Distillers & Chem. Corp. v. Brenner, 128 U.S. App. D.C. 386, 389 F. 2d 927 (D.C. Cir. 1967) 14, 14
Oldroyd v. Morgan, 58 App. D.C. 78, 24 F. 2d 1004 (App. D.C. 1928) 12
Robbins v. Steinbart, 57 F. 2d 378 (CCPA 1932) ... 12
Schnell v. Allbright-Nell Co., 348 F. 2d 444 (7th Cir. 1965), *cert. denied*, 383 U.S. 934 (1966) 14
Steen and Heuther v. Schroeder and Wagner, 36 F. 2d 518 (CCPA 1929) 12
Stone v. Pupin, 19 App. D.C. 396 (1902) 12
Tennessee Valley Authority v. Monsanto Chemical Co., 383 F. 2d 973 (5th Cir. 1967) 11
Varian v. Llewelyn, 178 F. 2d 997 (CCPA 1949) ... 12

Statutes:	Page
28 U.S.C. § 1256	2
28 U.S.C. § 1542	4
The Patent Act of 1952:	
35 U.S.C. § 101	3
102	3
112	3, 7
135	3
141	4, 9, 10
144	4, 9, 13
145	10
146	4, 9, 11, 13
Revised Statutes, Section 4915	11
Act of Mar. 2, 1929, 4 Stat. 1475	12
Federal Rules of Civ. Pro., Rule 52	14, 15
Supreme Court Rule 19	9
Other Authorities:	
Business Week, November 29, 1969, p. 28	5n
Stern & Gressman, Supreme Court Practice 161 (4th ed. 1969)	16n
Weekly Comp. of Pres. Docs., 6, 10 (1970)	5n



IN THE

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OCTOBER TERM, 1969

No. ____

JACK ST. CLAIR KILBY, *Petitioner*

v.

ROBERT N. NOYCE, *Respondent*

PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS

Petitioner respectfully prays that a writ of certiorari issue to review the judgment and opinion of the Court of Customs and Patent Appeals entered on November 6, 1969 in cross appeals Nos. 8182 and 8205 entitled, respectively, *Noyce* v. *Kilby* and *Kilby* v. *Noyce*.

OPINIONS BELOW

The opinion of the Court of Customs and Patent Appeals, reprinted in Appendix B, is reported at 416 F. 2d 1391 (CCPA 1969). The unreported opinion of the Patent Office Board of Patent Interferences is reprinted in Appendix D. The relevant portion of the Primary Examiner's decision is reprinted in Appendix E, and is not reported.

JURISDICTION

The judgment of the Court of Customs and Patent Appeals (Appendix B) was entered on November 6, 1969. A timely petition for rehearing was denied on January 29, 1970 (Appendix C), and this petition is filed within 90 days thereof. The jurisdiction of this Court is invoked under 28 USC § 1256 and the decision in *Brenner* v. *Manson*, 383 U.S. 519 (1966).

QUESTIONS PRESENTED

1. Does the orderly administration of the patent laws require all courts, empowered to review decisions of the Patent Office in *inter partes* cases, to apply a uniform standard of review, regardless of the route of review chosen by the litigants?

2. Is it consistent with the orderly administration of the patent laws for the Court of Customs and Patent Appeals, in reviewing decisions of the Patent Office, to depart from the standards established by this Court in *Morgan* v. *Daniels*, 153 U.S. 120 (1894), by disregarding the concurrent, technical, factual determinations of the Primary Examiner and the Board of Patent Interferences concerning the meaning of language in a

patent application to those skilled in the art to which the invention relates and by substituting its own interpretation of such language?

STATUTORY PROVISIONS INVOLVED

Inpertinent part, the following statutes are involved:

35 U.S.C. § 101:

> "Whoever invents . . . any new and useful . . . manufacture . . . may obtain a patent therefor, subject to the requirements of this title."

35 U.S.C. § 102:

> "A person shall be entitled to a patent unless—
>
> * * *
>
> (g) before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it."

35 U.S.C. § 112:

> "The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains . . . to make and use the same."

35 U.S.C. § 135:

> "Whenever an application is made for a patent which . . . would interfere with any . . . unexpired patent . . . the question of priority shall be determined by a board of patent interferences . . . whose decision, if adverse to the claim of an applicant, shall constitute the final refusal by the Patent Office of the claims involved, and the Commissioner may issue a patent to the applicant who is adjudged the prior inventor."

35 U.S.C. § 141:

"... A party to an interference dissatisfied with the decision of the board of patent interferences on the question of priority may appeal to the United States Court of Customs and Patent Appeals ..."

35 U.S.C. § 144:

"The United States Court of Customs and Patent Appeals, on petition, shall hear and determine such appeal on the evidence produced before the Patent Office and the decision shall be confined to the points set forth in the reasons of appeal."

35 U.S.C. § 146:

"Any party to an interference dissatisfied with the decision of the board of patent interferences on the question of priority, may have remedy by civil action ... unless he has appealed to the United States Court of Customs and Patent Appeals. In such suits the record in the Patent Office shall be admitted on motion of either party ... without prejudice to the right of the parties to take further testimony. The testimony and exhibits of the record in the Patent Office when admitted shall have the same effect as if originally taken and produced in the suit."

28 U.S.C. § 1542:

"The Court of Customs and Patent Appeals shall have jurisdiction of appeals from decisions of

(1) ... the Board of Interference Examiners of the Patent Office ... as to interferences, at the instance of ... any party to a patent interference, and such appeal ... shall waive his right to proceed under section [146] of Title 35."

STATEMENT OF THE CASE

Petitioner contends he is the first inventor of a semiconductor device with electrical connections adherent to the surface—an important feature of the very small electronic circuits known as integrated circuits.[1] These very small circuits are formed on a semi-conductor wafer illustrated in petitioner's patent application as being 0.200 × 0.080 × 0.0025 inches in length, width, and thickness, respectively (the length and width dimensions are approximately this size: ▬): In essence, the device consists of a hair-thin wafer of semi-conductive material covered more or less completely by a film of insulating material such as silicon oxide, on which minute electrical conductors make electrical connections between one or more components of a circuit.

In describing the invention here at issue, petitioner's application[2] stated:

> "Electrically conducting materials such as gold may then be laid down on the insulating material

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[1] Petitioner, an employee of Texas Instruments Incorporated, and respondent, assignor to Fairchild Camera & Instruments Corporation, have both received extensive recognition for their valuable contributions to this art. *Business Week* (November 29, 1969, at p. 28) said of the decision of the CCPA in the instant case that it concerned "the achievement that made possible a salable integrated circuit—the fastest selling semiconductor product [one of] the discoveries that propelled integrated circuits from lab curiosities to the near $500 million sales they should produce this year."

On January 1, 1970, petitioner was one of the six scientists named by the President of the United States to receive the National Medal of Science as ". . . deserving of special recognition by reason of their outstanding contributions to knowledge in the physical, biological, mathematical, or engineering sciences." The award was based on petitioner's ". . . original conceptions and valuable contributions in the production and application of integrated circuits." 6 *Weekly Comp. of Pres. Docs.* 10 (1970).

[2] Serial No. 791,602, filed February 6, 1959, which the opinion of the CCPA and this petition refer to as the '602 application.

to make the necessary electrical circuit connections."[3]

A continuation-in-part of petitioner's application was placed in interference with a patent of respondent,[4] a representative claim of which describes the invention as:

> "1. A semiconductor device comprising a body of semiconductor having a surface, . . . two closely spaced contacts a [sic] adherent to said surface, . . . an insulating layer consisting essentially of oxide of said semiconductor on and adherent to said surface, . . . and an electrical connection to one of said contacts comprising a conductor adherent to said layer, . . ."[5]

As the CCPA noted, the claims in interference describe a device consisting of electrical conductors that are adherent to the surface of an insulating layer of silicon oxide on a body of semi-conductor material. The factual question in this case is whether petitioner's disclosure taken as a whole (including the statement that the electrically conducting material may be "laid

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[3] R.113. The opinion of the CCPA includes the entire paragraph from which this sentence is taken. App. B: pp. 9a-10a; 416 F.2d at 1394. The sentence was carried over without change to a continuation-in-part application, filed January 29, 1962, directly involved here. R.16.

[4] Patent Appeals Nos. 8182 and 8205 are cross appeals from the decision of the Board of Patent Interferences in Interference No. 92,841. That interference involved U.S. Patent No. 2,981,871, granted April 25, 1961 to respondent Noyce on an application filed July 30, 1959, and the application of petitioner Kilby, Serial No. 169,557, filed January 29, 1962, as a continuation-in-part of U.S. Patent No. 3,138,743, granted June 23, 1964 to petitioner Kilby on the '602 application filed February 6, 1959. Patent No. 3,138,743 issued to Kilby covers integrated circuits, as such, while the continuation-in-part application here involved deals with electrical connections between the components making up the circuit.

[5] R.448-9; App. B, p. 5a; 416 F. 2d at 1392.

down on the insulating material") disclosed to "any person skilled in the art," 35 U.S.C. § 112, of miniature electronic circuits that the electrically conducting material is "adherent to" the insulating layer. Two levels of Patent Office tribunals decided this question in petitioner's favor.

The legal question is whether an appellate court may, on its own and without receiving any further evidence, disregard and overrule the concurrent findings of two successive expert triers of fact in the Patent Office. The effect of the CCPA's decision is to deny petitioner an important patent to which he is entitled.

The Primary Examiner in charge of petitioner's application in the Patent Office recognized that the specification of the '702 application, in the context of the art of making such tiny devices, necessarily conveyed to one skilled in that art that electrically conductive material "laid down on the insulating material" would thereafter adhere to that surface.[6] In the course of the interference itself, the parties took the depositions of experts. They recognized that the bare words "laid down" did not necessarily mean adherence. But as petitioner's expert did suggest, a coat of tar "laid down" on a highway serves no purpose if it does not adhere.[7] The Board of Patent Interferences accordingly found:

> "The clear import of [petitioner's] disclosure is that the device constructed in the manner taught would be usable under ordinary circumstances and

[6] R.444-5; App. E, p. 33a.

[7] R.237; App. B, p. 16a; 416 F.2d at 1397 n.8.

> would be expected to withstand normal handling. In our opinion this would necessarily involve some degree of adherence." [8]

These factual determinations, the CCPA held without citation of precedent, "do not . . . have any substantial significance." Instead, the court was apparently impressed by the fact that Webster's dictionary and petitioner's expert recognized that the words "laid down" in other contexts and for other purposes totally unrelated to semi-conductor devices (e.g., a match box laid down on a table) would not imply adherence.[9]

Petitioner respectfully suggests that this Court should not tolerate such arbitrariness in the administration of the patent laws, with their far reaching economic consequences in cases such as this. This Court should not permit the CCPA, without reason or authority, to depart from standards of judicial review set by this Court and honored by the several Courts of Appeals. He urges that it is the responsibility of this Court to take the opportunity presented by this case to reaffirm the appropriate standards for judicial review of Patent Office determinations and to direct the CCPA to apply the same standards as are applied in all other judicial reviews of decisions of the Board of Patent Interferences.

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[8] App. D, p. 25a.

[9] R. 237, App. B; p. 16a; 416 F. 2d at 1397.

REASONS FOR GRANTING THE WRIT

1. The Court Should Resolve a Conflict Between Federal Appellate Courts as to the Standards by Which Decisions of the Patent Office Board of Patent Interferences Are To Be Reviewed.

This Court's jurisdiction is invoked to resolve a conflict between federal appellate courts of coordinate jurisdiction. Decisions of the Patent Office, such as an award of priority by the Board of Patent Interferences, may be reviewed either by the CCPA or by the United States District Courts and Circuit Courts of Appeals. Any such review should be governed by the standards enunciated by this Court in *Morgan* v. *Daniel*, 153 U.S. 120 (1894). The District Courts and Circuit Courts of Appeals have followed the *Morgan* v. *Daniels* principle of deference to the expert triers of fact in the Patent Office. The CCPA has flouted the rule of *Morgan* v. *Daniels* and put itself in conflict with the courts of coordinate jurisdiction to review Patent Office rulings. In accordance with Supreme Court Rule 19 and the established practice thereunder, such a conflict on an important question of federal law constitutes a special and important reason for the grant of a writ of certiorari.

The patent law provides two routes of review from decisions of the Board of Patent Interferences. The first, pursuant to 35 U.S.C. § 141, authorizes review by the Court of Customs and Patent Appeals, solely "on the evidence produced by the parties before the Patent Office." 35 U.S.C. § 144. The second route, pursuant to 35 U.S.C. § 146, authorizes review by the United States District Courts and, from there, by the Circuit Courts of Appeals. In such cases, the testimony and exhibits of record in the Patent Office may be admitted

before the District Court and new evidence may also be considered by that court.

Comparable alternatives for review are authorized in *ex parte* cases—cases in which an applicant has sought and been denied a patent in a proceeding before the Patent Office limited to the applicant and without the participation of other private parties. 35 U.S.C. §§ 141, 145. In the context of an *ex parte* appeal brought in the Court of Customs and Patent Appeals and then reviewed by this Court, this Court held:

> "Obviously, the orderly administration both of our certiorari jurisdiction and of the patent laws requires that ultimate review be available in this Court, *regardless of the route chosen by the litigants.*" *Brenner* v. *Manson*, 383 U.S. 519, 527 (1966). (Emphasis supplied)

The same rationale should be applied to *inter partes* cases reviewable by the CCPA or the District Courts and ultimately the Circuit Courts of Appeals. All courts in which the matter may be considered should apply one legal principle.[10] If the CCPA hereafter follows its holding in this case, the administration of the patent laws will be affected by the route for judicial review chosen by the litigants. The Circuit Courts of Appeals have followed *Morgan* v. *Daniels*, and, until this case, the CCPA has also followed that standard. Only now has that court disregarded the uniform rule.

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[10] The two procedures envisioned by the patent law are obviously not intended to be identical in every way. As noted above, appeal to the CCPA is limited to the record made before the Patent Office while review in the District Courts permits the introduction of additional evidence. However, the legal standards applied by the reviewing court should be the same regardless of the route of review selected. See *Hoover* v. *Coe*, 325 U.S. 79, 87-8 (1945), in support of this view.

In *Morgan* v. *Daniels*, the party Daniels sought review in a federal court under Sec. 4915 Revised Statutes (the predecessor of the present 35 U.S.C. § 146) of a final decision of the Patent Office in an interference proceeding awarding priority to Morgan. Daniels did not avail himself of the right to introduce additional evidence, but submitted his case to the court solely upon the evidence adduced in the Patent Office. The Circuit Court disagreed with the final conclusion of the Patent Office and held that Daniels, not Morgan, was the first inventor, and therefore entitled to the patent. This Court reversed holding that "upon principle and authority, it must be laid down as a rule," that where the question decided in the Patent Office is one of priority of invention between contesting parties, "the decision there made must be accepted as controlling upon that question of fact in any subsequent suit between the same parties, unless the contrary is established by testimony which in character and amount carries thorough conviction." 153 U.S. at 125. The rule of *Morgan* v. *Daniels* is that, unless "clearly erroneous," the conclusion finally reached in the Patent Office on the factual determination of priority will not be overturned without additional evidence submitted to the reviewing court.

The Courts of Appeals for the several Circuits have consistently followed the rule of *Morgan* v. *Daniels*. See, e.g., *Minnesota Mining & Mfg. Co.* v. *Carborundum Corp.*, 155 F.2d 746, 748-9 (3d Cir. 1946); *Heston* v. *Kuhlke*, 179 F.2d 222, 226 (6th Cir. 1950); *Tennessee Valley Authority* v. *Monsanto Chemical Co.*, 383 F.2d 973, 978-9 (5th Cir. 1967). See also *General Motors Corp.* v. *R. E. Dietz Co.*, 420 F.2d 1303, 1305 (D.C. Cir. 1969) (dictum); *National Distillers & Chem-*

ical Corp. v. *Brenner*, 128 U.S. App. D.C. 386, 389 F.2d 927, 928 n. 1 (D.C. Cir. 1967) (*ex parte* case); *Gold* v. *Newton*, 254 Fed. 824, 827 (2d Cir. 1918) (same).

Prior to 1929, the Court of Appeals of the District of Columbia exercised the jurisdiction now vested in the Court of Customs and Patent Appeals, with respect to reviewing decisions of the Patent Office on priority questions. The District of Columbia Court of Appeals accepted as conclusive the concurrent decisions of Patent Office tribunals on a priority issue where the principal question raised by the appellant was the sufficiency of his opponent's original specifications. *Stone* v. *Pupin*, 19 App. D.C. 396 (1902). It was "the established rule that ordinarily such decisions [of the Patent Office] will be accepted by this court as conclusive, and will not be reversed, except in extreme cases, where palpable error has been committed." *Oldroyd* v. *Morgan*, 58 App. D.C. 48, 24 F.2d 1004, 1005 (App. D.C. 1928).

When jurisdiction to review such determinations was vested in the United States Court of Customs and Patent Appeals in 1929, Act of March 2, 1929, 4 Stat. 1475, no change in the standards of review appears to have been intended by the shift of jurisdiction. Indeed, the CCPA very early acknowledged as much and cited as precedents for its own decisions the opinions of the District of Columbia Court of Appeals. See e.g. *Stern and Heather* v. *Schroeder and Wagner*, 36 F.2d 518, 524-22 (CCPA 1929); *Robbins* v. *Steinbart*, 57 F.2d 378, 379 (CCPA 1932). See also *Varian* v. *Llewellyn*, 178 F.2d 997, 1004 (CCPA 1949).

The alternative procedures now provided by law for reviewing decisions of the Patent Office in priority matters should not produce different legal consequences. If an appeal is taken to the CCPA its de-

cision governs the further Patent Office proceedings in the case. 35 U.S.C. § 144. The decision of a District or Circuit Court of Appeals in a proceeding brought under 35 U.S.C. § 146 is equally a decision "of the Patent Office," governing the future action of the Commissioner of Patents. *Gandy* v. *Marble*, 122 U.S. 432, 440 (1887). This Court, after noting that Congress has preserved the alternative review procedures for more than a century, has stated that the effect of the two types of adjudication should be the same. *Hoover Co.* v. *Coe*, 325 U.S. 79, 87-8 (1945). Obviously, then, the orderly administration of the patent laws requires that this Court grant certiorari to correct the anomalous situation created by the Court of Customs and Patent Appeals' failure in this case to accord the rule of *Morgan* v. *Daniels* its proper role in the determination of the issue of priority.

2. The Court Would Have the First Occasion Since the Adoption of the Patent Act of 1952 To Pass Upon the Important Federal Question of How the U.S. Court of Customs and Patent Appeals Is To Review Decisions of the Patent Office in Inter Partes Cases.

The rule of *Morgan* v. *Daniels* is an old one. Although followed by the Circuit Courts of Appeals and, until now, by the CCPA, it has not received explicit reconsideration by this Court in recent years and never since the adoption of the current Patent Act nearly twenty years ago. This case presents an opportunity for the Court to express its views for the first time on the important issue of how decisions of the Patent Office in *inter partes* cases are to be reviewed on direct appeal to the CCPA.[11]

[11] This Court recently pointed out, in another context, the need for rationalizing the procedures of the patent system. It would be inconsistent with that view, in light of the backlog in the Patent Office and the Courts, to encourage parties to retry issues of fact determined by successive expert bodies of the Patent Office. See *Graham* v. *John Deere Co.*, 383 U.S. 1, 18 (1966).

In patent litigation, generally, this Court has recognized the desirability of applying strictly the policy underlying Rule 52 of the Federal Rules of Civil Procedure to limit the power of appellate courts to disregard or overturn factual determinations by the triers of fact, particularly two successive concurring findings, unless they are "clearly erroneous." See e.g., *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 336 U.S. 271, 275 (1949). Cf. *Great A&P Tea Co. v. Supermarket Equipment Corp.*, 340 U.S. 147, 153-4 (1950).

The Circuit Courts of Appeals have consistently followed the standard set by that rule. See, e.g., *Jiffy Enterprises, Inc. v. Sears Roebuck & Co.*, 306 F.2d 240, 243 (3d Cir. 1962), *cert. denied*, 371 U.S. 922 (1962); *Maytag Co. v. Murray Corp.*, 318 F.2d 79, 82 (6th Cir. 1963); *Schnell v. Allbright-Nell Co.*, 348 F.2d 444, 446 (7th Cir. 1965), *cert. denied*, 383 U.S. 934 (1966); *Ditto, Inc. v. Minnesota Mining & Mfg. Co.*, 336 F.2d 67, 69 (8th Cir. 1964); *Nat'l Distillers & Chemical Corp. v. Brenner*, 128 U.S. App. D.C. 386, 389 F.2d 927, 928 n. 1 (D.C. Cir. 1967).

The CCPA, as a court of appeals commensurate in stature with the Circuit Courts of Appeals, should be governed by the same review standards. As the cases cited above under Reason I indicate, the CCPA did heretofore follow such a rule. But in the instant case, concurrent factual determinations of Patent Office experts, at two levels of responsibility and function, were brushed aside with the statement that "we do not regard the concurrence of the examiner and board to have any substantial significance in the present circumstances".[12] Not only did the CCPA disregard con-

[12] App. B, p. 17a; 416 F. 2d at 1398.

current factual determinations of the Patent Office tribunals; it also disregarded the injunction of Rule 52 as to the appropriate deference appellate courts must give the findings of a trier of facts.

At a number of points in its opinion, the CCPA suggests it expected the language of petitioner's application to teach a layman how to practice the invention. But the patent law does not require the inventor to describe his invention in terms enabling anyone to fabricate semiconductor devices in his basement. The patent is addressed to a "person skilled in the art." As this Court has itself said:

> "The specification of the patent is not addressed to lawyers, or even to the public generally but to the [persons skilled in the relevant art], and any description which is sufficient to apprise them in the language of the art of the definite feature of the invention . . . is sufficiently definite." *Carnegie Steel Co. v. Cambria Iron Co.*, 185 U.S. 403, 437 (1902).

More recently, in *Brenner* v. *Manson*, 383 U.S. 519 (1966), this Court suggested that in technical areas, concurrent findings by the Primary Examiner and Patent Office Board of Appeals are not to be lightly overturned. 383 U.S. at 531. In that *ex parte* case, this Court noted that the CCPA had abandoned its policy in favor of its own new rule.[13] This Court considered correction of the CCPA's departure from settled practice sufficiently important to the administra-

[13] The CCPA decided that a patent could be obtained for the process for making a product even if the product had no known utility. This Court determined, as had the Patent Office, that such a process could not be "useful" within the meaning of the Patent Act or its underlying constitutional authorization.

tion of the patent laws to warrant granting a writ of certiorari. The instant case presents a more far reaching question concerning the practices of the CCPA. If a writ of certiorari were granted here, this case would be the first *inter partes* proceeding appealed to the CCPA to come before the Court on the merits. Petitioner respectfully urges the Court to hear it.

3. The Court Should Correct the Decision of the Court Below Which Conflicts With Applicable Decisions of the Court

As the preceding discussion indicates, the Court of Customs and Patent Appeals has disregarded a salutary rule of law adopted by this Court in 1891 in *Morgan* v. *Daniels* and recognized as appropriate for technical patent cases as recently as 1966 in *Brenner* v. *Manson*. The correction of a decision on an important question of federal law, particularly when it represents a novel and unwarranted departure from settled practice, provides a further basis for granting a writ of certiorari.

CONCLUSION

A conflict between decisions of the courts of appeals has been a traditional ground for the exercise of this Court's discretion to grant a writ of certiorari. The conflict between the standard of review applied by the Circuit Courts of Appeals on the one hand and the CCPA in this case on the other requires resolution by this Court.[14]

No less important, this Court has never before heard on the merits an *inter partes* appeal from the CCPA. It is, therefore appropriate, since the CCPA in this case has now departed significantly from the standards

[14] See Stern & Gressman, Supreme Court Practice 161 (4th ed. 1969).

of decision adopted by this Court and consistently followed by other appellate courts, that this Court grant the requested writ.

In sum, petitioner respectfully urges the Court to hear this case on its merits, by issuing a writ of certiorari to the Court of Customs and Patent Appeals.

Respectfully submitted,

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APPENDIX A

Statutory Provisions

35 U.S.C. § 101. Inventions patentable

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

35 U.S.C. § 102. Conditions for patentability; novelty and loss of right to patent

A person shall be entitled to a patent unless—

* * * * * * * * * *

(g) before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other.

* * * * * * * * * *

35 U.S.C. § 112. Specification

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, * * *

* * * * * * * * * *

35 U.S.C. § 135. Interferences

(a) Whenever an application is made for a patent which, in the opinion of the Commissioner, would interfere with

any pending application, or with any unexpired patent, he shall give notice thereof to the applicants, or applicant and patentee, as the case may be. The question of priority of invention shall be determined by a board of patent interferences (consisting of three examiners of interferences) whose decision, if adverse to the claim of an applicant, shall constitute the final refusal by the Patent Office of the claims involved, and the Commissioner may issue a patent to the applicant who is adjudged the prior inventor. * * *

* * * * * * * * * * *

35 U.S.C. § 141. Appeal to Court of Customs and Patent Appeals

* * * A party to an interference dissatisfied with the decision of the board of patent interferences on the question of priority may appeal to the United States Court of Customs and Patent Appeals, * * *

* * * * * * * * * * *

35 U.S.C. § 144. Decision on appeal

The United States Court of Customs and Patent Appeals, on petition, shall hear and determine such appeal on the evidence produced before the Patent Office, and the decision shall be confined to the points set forth in the reasons of appeal. Upon its determination the court shall return to the Commissioner a certificate of its proceedings and decision, which shall be entered of record in the Patent Office and govern the further proceedings in the case.

* * * * * * * * * * *

§ 146. Civil action in case of interference

Any party to an interference dissatisfied with the decision of the board of patent interferences on the question of priority, may have remedy by civil action, if commenced within such time after such decision, not less than sixty days, as the Commissioner appoints or as provided in section 141 of this title, unless he has appealed to the

United States Court of Customs and Patent Appeals, and such appeal is pending or has been decided. In such suits the record in the Patent Office shall be admitted on motion of either party upon the terms and conditions as to costs, expenses, and the further cross-examination of the witnesses as the court imposes, without prejudice to the right of the parties to take further testimony. The testimony and exhibits of the record in the Patent Office when admitted shall have the same effect as if originally taken and produced in the suit. * * *

* * * * * * * * * * *

28 U.S.C. § 1542. Patent Office decisions

The Court of Customs and Patent Appeals shall have jurisdiction of appeals from decisions of:

(1) the Board of Appeals and the Board of Interference Examiners of the Patent Office as to patent applications and interferences, at the instance of an applicant for a patent or any party to a patent interference, and such appeal by an applicant shall waive his right to proceed under section 63 of Title 35; and

* * * * * * * * * * *

APPENDIX B

Opinion and Judgment of the C.C.P.A.

UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS

October Term, 1969

Patent Appeal No. 8182

Interference No. 92,841

ROBERT N. NOYCE, *Appellant*,

v.

JACK ST. CLAIR KILBY, *Appellee*.

October Term, 1969

Patent Appeal No. 8205

Interference No. 92,841

JACK ST. CLAIR KILBY, *Appellant*,

v.

ROBERT N. NOYCE, *Appellee*.

November 6, 1969

ALMOND, *Judge*.

These are cross-appeals from the decision of the Board of Patent Interferences awarding priority of invention as to counts 1-4 to Kilby and counts 5 and 6 to Noyce in Interference No. 92,841 involving Noyce patent No. 2,981,877, issued April 25, 1961 on an application[1] filed

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[1] Serial No. 830,507.

July 30, 1959, and Kilby application serial No. 169,557, filed January 29, 1962.

The sole issue is whether counts 1-4, the subject matter of No. 8182 taken by Noyce, and count 6,[2] involved in No. 8205 brought by Kilby, are supported by a prior copending application of Kilby, serial No. 791,602, filed February 6, 1959 (hereinafter the '602 application).[3] For reasons hereinafter stated, we find that the counts in issue are not supported by the '602 application, and therefore *reverse* the decision of the board as to counts 1-4 in No. 8182 and *affirm* it as to count 6 in No. 8205.

The subject matter in issue is a semiconductor device including an electrical lead or connection thereto, which device is suitable for use in integrated electronic circuits of very small size.[4] Count 1 is representative:

> 1. A semiconductor device comprising a body of semiconductor having a surface, said body containing adjacent P-type and N-type regions with a junction therebetween extending to said surface, two closely spaced contacts a [sic] adherent to said surface upon opposite sides of and adjacent to one portion of said junction, an insulating layer consisting essentially of oxide of said semiconductor on and adherent to said surface, said layer extending across a different portion of said junction, and an electrical connection to one of said contacts comprising a conductor adherent to said layer, said conductor extending from said one

---

[2] As to count 5, which was also involved in No. 8205, Kilby withdraws his appeal in his brief here and the appeal therefore is dismissed as to that count.

[3] Issued June 23, 1964 as patent No. 3,138,743.

[4] As an example of the minute size of the circuits, the dimensions of the semiconductor wafer of Fig. 6a of the Kilby '602 application, which figure is reproduced and discussed hereinafter, are given as 0.200 x 0.080 x 0.0025 inches.

contact over said layer across said different portion of the junction, thereby providing electrical connections to both of the closely spaced contacts.

A multi-device semiconductor and lead structure embodying the invention is shown in Figs. 3 and 4 of the Noyce patent, plan and sectional elevation, respectively, as follows:

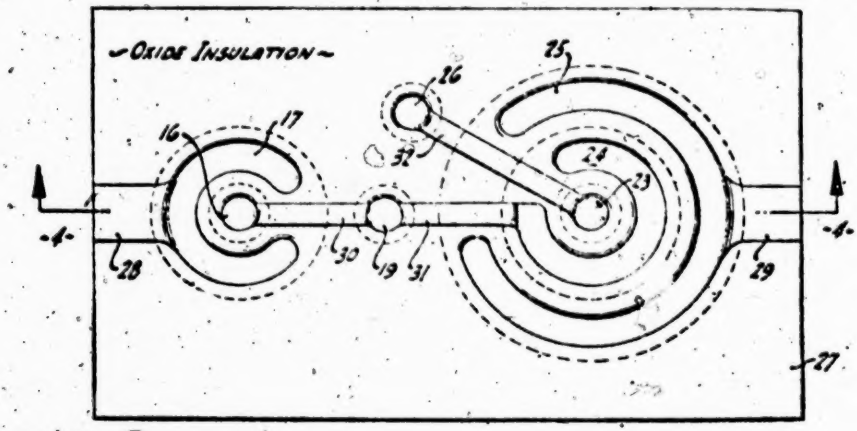


FIG. 3

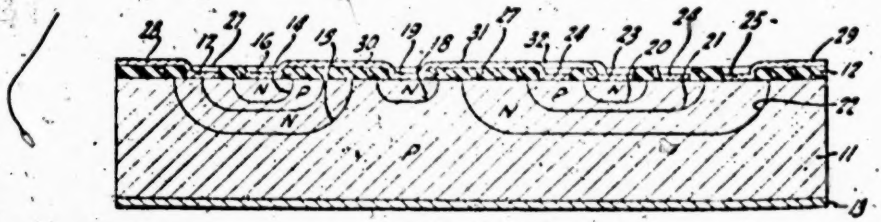


FIG. 4

The illustrated device includes a semiconductor body 11 of silicon of the P-type with one side having a surface 12 and the other side plated with a metal coating 13 which serves as an electrical contact. A plurality of circuit elements are formed within and on the body of silicon by diffusing N-type and P-type dopants, restricted to specific

areas by known masking techniques, through the surface 12 to form a plurality of N-type and P-type dopants, restricted to specific areas by known masking techniques, through the surface 12 to form a plurality of N-type and P-type semiconductor regions which are separated from the underlying P-type region and from each other by a plurality of disked, P-N junctions of various diameters and depths.

Toward the left end of the structure illustrated in Figs. 3 and 4 is shown an N-type region overlying a small P-type region and separated therefrom by a disked junction 14. The small P-type region overlies another N-type region, and the latter N-type region in turn overlies the large P-type region comprising the bulk of the body and is separated therefrom by a disked junction 15. A discoid metal contact 16, adherent to surface 12 within junction 14, makes electrical connection to the upper N-type region. Electrical connection to the two regions between junctions 14 and 15 is made through a C-shaped metal contact 17 adherent to those regions. Since the two intermediate regions of semiconductor material are electrically interconnected by the contact 17, the resulting structure comprises two rectifying P-N junctions in series circuit.

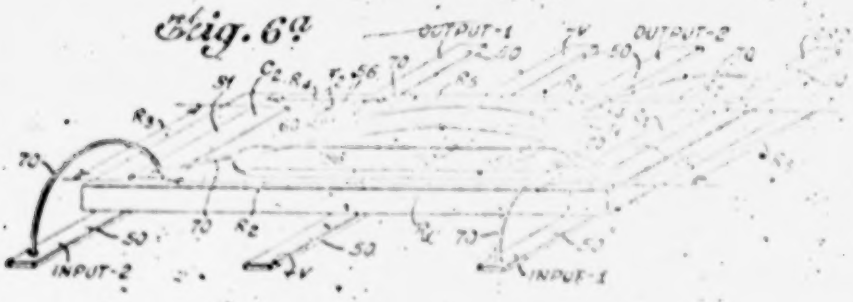
Except for the contacts 16 and 17 and the contacts for other semiconductor devices shown to the right of the device just described, the entire surface 12 is covered with an insulating layer of oxidized silicon. That insulating layer may be formed upon the exposed surface of the silicon during the diffusion of the dopants into the silicon and the contact areas subsequently cleared of the layer by photoengraving techniques. Afterward, conductive metal such as aluminum may be deposited by vacuum deposition and photoengraving procedures may be used subsequently to remove all the deposited metal except that forming the contacts, such as 16 and 17, and electrical connecting leads thereto such as are shown at 28 and 30. Thus the metal lead strip 30 constituting the conductor from

contact 16 passes over junctions 14 and 15 in insulated relationship thereto as the result of intervening oxide layer 27. The Noyce specification emphasizes throughout that the lead strips or conductors are adherent to the oxide layer.

The conductor 30 similarly passes in insulated relationship over another junction 18 of a semiconductor device designed to serve as a capacitor to make electrical connection to terminal 19 of that device. Additional semiconductor devices shown in the drawing include a transistor.

The disclosure of Kilby application '602 is best considered in connection with Fig. 6a thereof:

Fig. 6a



A thin wafer of single crystal semiconductor material containing a diffused P N junction shown there has been processed and shaped to form an integrated electronic circuit constituting a multivibrator. Among the elements of the circuit are resistors R_1, R_2 and R_3 and capacitors C_1 and C_2. Also formed are mesa transistors[3] T_1 and T_2. Although a semiconducting wafer that is "preferably silicon or germanium" is mentioned, P type germanium is said to

[3] The application includes an enlarged illustration of such a transistor revealing that its designation arises from its having a region of one type conductivity, as the base region, projecting like a plateau or *mesa* from the surface of a region of a different type conductivity, as the collector region.

be used for the device shown. In producing the device, one side of the wafer is lapped and polished and then subjected to an antimony diffusion process to provide an N-type layer. Gold is evaporated through a mask to produce areas 51 to 54 which provide ohmic contact[6] with the N-type region such as the transistor base connections. Aluminum is evaporated through a mask shaped to provide the transistor emitter areas 56, which areas form rectifying contacts with the N-type layer. After utilizing a photosensitive resist process to etch the wafer to the proper shape, the photoresist is removed by a solvent and mesa areas 60 are masked by the same photographic process, and the wafer is again etched and the N-type layer removed in the exposed areas. Gold wires 70 are then thermally bonded to appropriate areas to make the necessary electrical connections. As examples, one wire 70 interconnects the emitter areas 56 of the two transistors T_1 and T_2 and base areas of the transistors are connected to contacts 51 and 52, respectively.

Kilby's Fig. 6a embodiment shows the gold connecting wires 70 insulated from the other circuit components and from each other by reason of their extending upwardly from the wafer into the air. However, the application describes a modification in a partial paragraph thereof as follows:

> Instead of using the gold wires 70 in making electrical connections, connections may be provided in other ways. For example, an insulating and inert material such as silicon oxide may be evaporated onto the semiconductor circuit wafer through a mask either to cover the wafer completely except at the points where electrical contact is to be made thereto, or to cover only selected portions joining the points to be electri-

[6] The record reveals that an ohmic contact is linear in contrast to the contact at a P-N junction which is non-linear or rectifying.

cally connected. Electrically conducting material such as gold may then be laid down on the insulating material to make the necessary electrical circuit connections.

The issue which we must determine is whether Kilby '602 supports recitations such as those in count 1, supra, which require a conductor that is adherent to the surface of an insulating layer of oxide of the semiconductor and provides an electrical connection passing across a junction at the surface of the semiconductor between P-type and N-type regions.

Kilby's continuation-in-part application directly involved in the interference, filed after the Noyce patent issued, contains much material not included in the parent '602 application and its support for the counts in issue is unquestioned. Thus, the later application adds to the statement in '602 that electrically conducting material such as gold may be "laid down" on the insulating material, a disclosure of "gold ribbons [redacted] plated onto and adhering to the silicon oxide layer." The involved application also adds a disclosure of a method for applying gold interconnections and includes several new figures which, taken with their description, clearly disclose the structure of the counts.

The board found the reference to an insulating material "such as silicon oxide" in the described modification of Fig. 6a supports the requirement for an insulating material consisting of "oxide of said semiconductor," because of the disclosure that either silicon or germanium could be used as semiconductor material, which precedes the statement that the wafer of Fig. 6a is of germanium. Apparently Noyce does not challenge that conclusion here.

With respect to the requirement of count 1 for a conductor adherent to the layer of insulation, the board referred to testimony taken by Noyce "to show that gold

film deposited on silicon oxide is not adherent thereto."[7] It stated that it was not particularly impressed by that testimony because it was directed exclusively to gold and took the view that the statement in Kilby '602 that electrically conducting material "such as gold" may be laid down merely gives gold as an example. The board then concluded that "one skilled in the art of fabricating such devices * * * would have no difficulty in selecting a metal which would unquestionably adhere to the silicon oxide layer." It further referred to the fact that Kilby '602 discloses forming a capacitor on a semiconductor wafer by applying a coating of aluminum on a layer of silicon oxide previously provided on the wafer and stated that there was no suggestion by Noyce that aluminum or some other material known to be adherent would not be satisfactory to obtain a "conductive film."

The board also specifically considered the limitation in count 1 reading:

> * * * said conductor extending from said one contact over said [insulating] layer across said different portion of the junction * * *.

It viewed that limitation as requiring only one insulating layer and one conducting film thereon crossing a junction between the P-type and N-type regions and stated that it would be satisfied if the single conductor 70 interconnecting the emitter contacts 56 of Fig. 6a of Kilby were "provided by a conductive film on a layer of silicon oxide." While conceding that Kilby '602 does not expressly point out, or distinctly show, where the junction between P-type and

[7] It appears that the testimony for Noyce might be more precisely described as directed to showing that gold could not be deposited on silicon dioxide so as to adhere satisfactorily thereto *at the time the Kilby '602 application was filed in 1959.* Kilby joined issue on that matter and both parties conducted inter partes tests. Since we do not rest our decision here on those tests, they will not be further discussed.

N-type regions is found or where there is a "different portion" of that junction which is crossed by the insulating layer and overlaying conductor, the board held that those features "are necessarily implicit therein."

Before us, Noyce stresses the argument that a "conductor adherent to the surface of the oxide and crossing a junction" is an essential feature of the invention and is not disclosed by the Kilby '602 application. He observes that Kilby must rely for the "conductor adherent" limitation of count 1 on the sentence in the reference to the modification of his Fig. 6a structure which states that "[e]lectrically conducting material such as gold may then be laid down on the insulating material to make the necessary electrical circuit connections." It is Noyce's position that this suggestion that the electrical connection be "laid down" on the insulating layer does not teach that it be "adherent" thereto and that such adherency is not otherwise taught in the '602 application.

Kilby does not deny that his '602 application lacks language stating that a conductor in his modified Fig. 6a construction is "adherent" to the insulating layer. He nevertheless contends that the application should be interpreted as supporting the limitations in question.

As pointed out by Noyce, the present case generally parallels the case of *Dyer* v. *Field*, 55 CCPA 771, 386 F.2d 466, 156 USPQ 85 (1967). There, the junior party Field was involved in interference on a continuation-in-part application which was expanded substantially over the parent application relied on for priority with respect to the very feature of the invention in issue that was in controversy. The same is true here with the additional aspect that Kilby's directly involved application was filed after Noyce's patent issued. However, we agree with Kilby that Field's being involved in the interference on a new application having an expanded disclosure "alone was not what

caused the final ruling adverse to Field." Rather, the decision there was based on a finding that the earlier Field application did not disclose the invention in issue. So too, the determinative matter here is whether earlier filed Kilby '602 supports the counts. The criterion for determining whether an application supports a count is whether the "necessary and only reasonable construction" to be given the disclosure by one skilled in the art is one which provides such support. *Binstead* v. *Littmann*, 44 CCPA 839, 242 F.2d 766, 113 USPQ 279 (1957). That requirement is the same where one relies on the earlier application for support in order to obtain the benefit of its filing date as where support in an application directly involved in interference is in issue. See *Geiger* v. *Cramer*, 50 CCPA 1386, 318 F.2d 757, 138 USPQ 125 (1963). The burden on one copying a claim from a patent was recently summarized in *Gabelmann* v. *Gang*, 56 CCPA 1013, 408 F.2d 758, 161 USPQ 216 (1969), as follows:

> One copying a claim from a patent has the burden of showing that his application clearly supports the count. In determining applicant's right to make a copied claim, all limitations in the claim will be considered material and doubts arising as to such right must be resolved against the copier. Where support must be based on an inherent disclosure, it is not sufficient that a person following the disclosure might obtain the result set forth in the count; it must invariably happen. See *Smith* v. *Wehn*, 50 CCPA 1544, 318 F.2d 325, 138 USPQ 52, and *Dreyfus and Harrison* v. *Sternau*, 53 CCPA 1050, 357 F.2d 411, 149 USPQ 63.

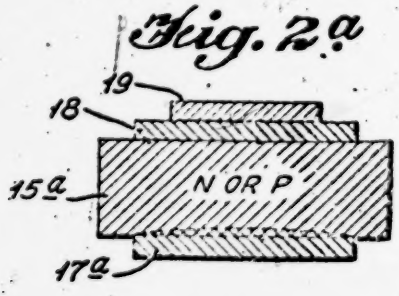
Although the board held here, as already noted, that one skilled in the art would have no difficulty in "selecting" a metal which would adhere to the silicon oxide layer suggested in the Kilby '602 application, that finding avoids the real issue which is whether the application includes a

disclosure that the conductor is to be adherent to the layer. The board did subsequently get to that issue, stating:

> Noyce urges that there is nothing in the paragraph relied on in the parent Kilby case to indicate that Kilby had any concern about whether the conducting material would have any adherence at all since there is only the statement that the conducting material be "laid down on the insulating material". This is true only to the extent that Kilby clearly suggested no particular degree of adherence as mentioned above. *We think that the clear import of the Kilby disclosure is that the device constructed in the manner taught would be usable under ordinary circumstances and would be expected to withstand normal handling. In our opinion this would necessarily involve at least some degree of adherence* * * *. [Emphasis supplied.]

No sound support is seen for the board's view that "at least some degree of adherence" would necessarily be involved. As pointed out by Noyce, the implication of the reasoning by which the board reaches that conclusion is that "*Kilby's own preferred embodiment* in '602, shown in Fig. 6a, where the gold wires 70 clearly were not adherent, *was not 'usable under ordinary circumstances.'*"

The disclosure relied on by the board of a coating of aluminum on silicon oxide in a capacitor is illustrated in Fig. 2a of Kilby '602, reproduced below:



There, a body 15a of semiconductor material constitutes one plate of the capacitor. Silicon oxide is applied to that body by evaporation or thermal oxidation techniques to serve as the dielectric 18 of the capacitor. The second plate 19 is provided by evaporating on the oxide dielectric a conductive material, gold or aluminum being described as satisfactory.

While that disclosure indicates that it was known in 1959 that aluminum could be deposited on an oxide layer to form the plate of a capacitor, it does not seem to us to constitute any clear suggestion that conductors interconnecting terminals of semiconductor devices should be so deposited.

The gist of the reasoning of Kilby on the point under consideration is found in the following argument in his brief:

> The word "laid" (the past participle of the word "lay") has quite a large number of meanings. In addition to laying down as a carpet on a floor, there are other meanings given in Webster's International Dictionary, such as to dispose of as over a surface; as to lay a pavement; to coat. For the word "laying" the meaning is given as that of "the act of one who acts or sets, puts, places, fixes, etc." The intention of Kilby was to describe in a very broad sense the act of making appropriate and necessary electrical connections to semiconductor devices wherein an inert and insulating material such as silicon oxide separated the electrical conductor from the semiconductor substrate. It was Kilby's purpose to describe an operative embodiment so as to teach the art the means of making necessary electrical connections in integrated circuits. The words "laid down" quite obviously mean depositing or plating by an appropriate means such as that referred to in his application in connection with the evaporation of aluminum and gold onto the same kind

> of substrates and same kinds of materials. The language is quite clear to one desiring to make the same kinds of electrical connections unless one deliberately intends to misunderstand. Therefore, it seems clear that an effort has been made to find a lack of teaching where none exists. Neither the Primary Examiner nor the Board of Patent Interferences had any difficulty with the language in question.

That argument embodies an inherent concession that "laid down" can cover a relationship where adherency is lacking as well as one where it exists, which fact precludes any conclusion that the term "laid down" per se meets the requirement that the claimed features must be inherently disclosed in order to find support in an application. It is also apparent that Kilby has not demonstrated that the term "laid down" had at the time of filing of the '602 application in 1959, or has since, acquired a meaning in electronic or semiconductor arts which necessarily connotes adherence.[8] The position that "laid down" means

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[8] Each party took testimony of a witness who was an expert in the art and both of those witnesses agreed that "laid down" does not necessarily imply adherence. Kilby's expert, Professor Maurer, testified:

> XQ29. * * * supposing I do the operation with a long piece of wire and I just lay it down across the pads? A. Yes.
>
> XQ30. And then I come with the heater and bond the two ends, haven't I laid down this gold wire on the device? A. I think the term could include that. As I believe I testified before, I don't consider that laid down implies more than the act of placing in contact.
>
> Now, you may lay down an object on a table. I say I laid down the match box. That does not imply that the match box adheres to the table. But I might say I laid down a coat of tar on a highway and that would certainly imply that the tar adhered to the ground. It wouldn't serve its purpose otherwise.

depositing or plating by means such as are referred to in the application "in connection with the evaporation of aluminum and gold onto the same kind of substrates and same kinds of materials" cannot stand analysis. The disclosure in Kilby '602 of evaporating conductive metal onto a substrate of oxide relates to the forming of the plate 19 of the capacitor of Fig. 2a as discussed hereinabove. As there pointed out, that plate is an element of the capacitor and is not a conductor for making an electrical connection between circuit elements. We do not find any suggestion in the application that would lead a person of ordinary skill in the art to interpret Kilby's discussion of a modified electrical connecting means as teaching the use of a process he discloses only for making a capacitor plate.

As to Kilby's statement that neither the examiner nor the board had "any difficulty with the language in question," we do not regard the concurrence of the examiner and board to have any substantial significance in the present circumstances. The record shows merely that the examiner held that there was support in the portions of the '602 application considered here and not that he gave any reasons for his views. The analysis by which the board reached its conclusion is considered to be clearly in error for the reasons already pointed out.

In summary, the best that can be said for Kilby's position with respect to the recitation in count 1 regarding a "conductor adherent" to the proposed layer of oxide and crossing a junction of the semiconductor is that there might be a possibility that one skilled in the art following the Kilby '602 application would have provided such a structure. However, we are not convinced that such person would inevitably do so or that such structure would result from the necessary and only reasonable construction of the disclosure by one skilled in the art.

Since counts 2-4, which call for "a metal strip" which is "adherent" to the oxide layer, possess in substance the

same requirements as count 1 on the point under discussion, it must be held that the board erred in finding support for those counts as well as for count 1.

As to count 6, the board held that the Kilby '602 application lacked support for a limitation therein regarding the circuit in which the semiconductor device is to be used. Before us, Noyce concedes error in that particular holding. However, as pointed out by Noyce, that count embodies substantially the same limitations regarding the adherent conductor which we have found unsupported in counts 1-4. The board's holding that the '602 application fails to support count 6 must therefore be sustained on the latter basis.

The decision is *reversed* as to counts 1-4 involved in No. 8182 and *affirmed* as to count 6 in No. 8205.

MODIFIED.

APPENDIX C

Judgment of the Court of Customs and Patent Appeals on Rehearing

UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS
717 MADISON PLACE NW.
WASHINGTON, D. C. 20439

January 29, 1970

Mr. Ellsworth H. Mosher
Stevens, Davis, Miller and Mosher
300 Munsey Building
Washington, D. C. 20004

Re: Noyce v. Kilby
Patent Appeal No. 8182

Kilby v. Noyce
Patent Appeal No. 8205

Dear Sir:

This is to advise that the court today denied the petition for rehearing filed in the above appeals.

Sincerely yours,

GEORGE E. HUTCHINSON
Clerk

APPENDIX D

Opinion of the Patent Office Board of Patent Interferences of February 24, 1967

IN THE UNITED STATES PATENT OFFICE
BEFORE THE BOARD OF PATENT INTERFERENCES

Patent Interference No. 92,841

KILBY v. NOYCE

Semiconductor Device And Lead Structure

Application of Jack St. Clair Kilby filed January 29, 1962, Ser. No. 169,557

Patent granted Robert N. Noyce April 25, 1961, No. 2,981,877 on application filed July 30, 1959, Ser. No. 830,507

Messrs. Stevens, Davis, Miller and Mosher, Mr. S. M. Mims, Jr., Mr. J. O. Dixon, Mr. A. M. Hassell, Mr. J. G. Graham, Mr. R. C. Peterson, Mr. John G. Graham and Mr. Henry K. Woodward for Kilby

Mr. Roger S. Borovoy for Noyce

Boys, Williams and Capelli, Examiners of Interferences
Boys, Examiner of Interferences

This interference between the above identified application and patent came to final hearing on the basis of testimony taken by both parties and ancillary matters. Both parties took testimony, filed briefs, and were represented at the final hearing.

During the motion period, Noyce moved to dissolve on the ground that the counts were unpatentable to Kilby because of an alleged publication of the subject matter involved more than a year prior to the filing of the involved Kilby application, and to dissolve as to counts 5, 6 and 8 on the ground that the Kilby application does not support these counts. The Primary Examiner denied the motion as to both grounds.

During his time for taking testimony in chief, the junior party Kilby took certain testimony relating to priority of invention. During his time for taking testimony, the senior party Noyce took no priority testimony, but took the testimony of expert witnesses attempting to show that the use of a gold conductive film as disclosed in earlier Kilby applications (which were relied on by the Primary Examiner in his decision on motions and which are set forth in Kilby's preliminary statement) was actually inoperative because of non-adherence. During his period for taking rebuttal testimony, Kilby took the testimony of an expert witness in connection with *inter partes* tests intended to show that gold film could be made to adhere to silicon oxide as set forth in the counts. Noyce then moved to take surrebuttal testimony which was granted. Kilby's subsequent motion to take sur-surrebuttal testimony was denied, although he was permitted to file notice of reliance on certain publications under Rule 282.

In his brief and orally at the hearing, Kilby relies solely on his prior application No. 791,602 filed February 6, 1959, and withdrew any contention for priority as to counts 7, 8 and 9. At the hearing counsel for Kilby stated that consideration of his priority testimony would be unnecessary. This express limitation of issues is appreciated.

Generally stated, the invention relates to providing electrical connections to the different regions of a semiconductor device having surface oriented p-n junctions. More particularly, it concerns the provision of an insulating coating such as silicon oxide on the semiconductor surface and crossing a p-n junction, and forming thereon a conductive metal film, also crossing the p-n junction and with one end forming a connection with one of the contacts of the device.

The parent Kilby application No. 791,602 has matured into patent No. 3,138,743 and our reference will be to the specification and drawings of that patent. This patent

relates to what is now known as an integrated circuit, in which a wafer of semiconductor material is treated in selected areas to provide desired resistors, capacitors and p-n junctions, connected as desired by metallic film conductors so that an electronic circuit can be provided as a single very small and compact unit. Kilby primarily relies on his Figure 6a and the related portion of the specification. This figure shows pictorially a multivibrator circuit on a single wafer. Two spaced mesa transistors T_1 and T_2 are provided with emitter contacts 56 and C shaped base contacts 53 and 54. Connections are shown as wires 70. After describing the treatment of the wafer to obtain the various circuit elements the specification states (column 6, lines 56-68):

> Gold wires 70 were then thermally bonded to the appropriate areas to complete the connections and a final clean up etch given. Instead of using the gold wires 70 in making electrical connections, connections may be provided in other ways. For example, an insulating and inert material such as silicon oxide may be evaporated onto the semiconductor circuit wafer through a mask either to cover the wafer completely except at the points where electrical contact is to be made therefrom or to cover only selected portions joining the points to be electrically connected. Electrically conducting material such as gold may then be laid down on the insulating material to make the necessary electrical circuit connections.

Count 1 reads as follows:

Count 1

> A semiconductor device comprising a body of semiconductor having a surface, said body containing adjacent P type and N type regions with a junction therebetween extending to said surface, two closely spaced contacts adherent to said surface upon opposite sides of and adjacent to one portion of said junction, an insulating layer consisting essentially of oxide of said semiconductor on and adherent to said surface, said layer extending across a different portion of said junction, and an electrical connection to one of said con-

> facts comprising a conductor adherent to said layer, said conductor extending from said one contact over said layer across said different portion of the junction, thereby providing electrical connections to both of the closely spaced contacts.

Noyce contends that three specific requirements of count 1 are not satisfied by the disclosure of Kilby '602. First he refers to the requirement,

> * * * an insulating layer consisting essentially of oxide of said semiconductor on and adherent to said surface, * * *.

He then urges that this requires that the oxide of the insulating layer be an oxide of the semiconductor material of the wafer, noting that at column 6, lines 22 and 23 of the Kilby patent it is stated that germanium was used, and that the silicon oxide mentioned in the subsequent paragraph quoted above is not an oxide of germanium. Noyce seems to urge that an oxide evaporated on the substrate as mentioned in the latter paragraph is not an "oxide of said semiconductor".

We do not accept this contention. At column 6, lines 20 and 21, the Kilby patent '743, states that the semiconducting wafer may be either silicon or germanium. Using silicon as taught, with a layer of silicon oxide, the layer is an "oxide of said semiconductor" as required by the count. We do not consider that the structural language in question requires any particular method of providing the oxide layer. It could be formed *in situ* or deposited by evaporation as suggested in the Kilby patent. We cannot read into a count limitations which are not expressly set out. Martin v. Friendly, 49 CCPA 1181; 1932 C.D. 418; 58 F2d 421; 13 USPQ 201; and Jepson v. Egly, 43 CCPA 853; 1956 C.D. 223; 231 F2d 947; 109 USPQ 354.

Noyce further contends that Kilby patent '743 does not disclose "a conductor adherent to said layer" as required by count 1. He urges that the Kilby patent does not suggest that the electrically conducting material must be ad-

herent. He went to considerable lengths in taking testimony, including surrebuttal testimony, in attempting to show that gold film deposited on silicon oxide is not adherent thereto. We are not particularly impressed by this testimony since it is directed exclusively to gold so far as the test and discussion of lack of adherence to silicon oxide are concerned while the quoted portion of Kilby '743 refers to gold as merely one example in stating, "Electrically conducting material such as gold may then be laid down * * *." None of the expert witnesses made any statement to the effect that no electrical conducting materials were known which would adhere to silicon oxide. In fact Noyce's own witness, Dr. Pearson stated (Noyce record 28, Q65):

> There are classes of metals which will stick to silicon oxide and there are classes of metals which will not stick. Now, gold happens to be in the class which will not stick adherently. Whereas, aluminum, platinum, radium, r(h)odium, are good stickers, good adherent materials.

This seems to indicate that one skilled in the art of fabricating such devices would be familiar with the adhering properties of the various materials and would have no difficulty in selecting a metal which would unquestionably adhere to the silicon oxide layer. In this connection we note as has been urged by Kilby that in describing the formation of a capacitor on a semiconductor wafer a coating of aluminum on an insulating layer of silicon oxide is suggested in the Kilby patent '743:

> Gold and aluminum have been found to be satisfactory materials for plate 19. (column 5, lines 15 and 16.)

Thus, viewing the entire specification of Kilby patent '743, we believe that the use of materials other than gold, particularly aluminum, is suggested to obtain a conductive film and there has been no suggestion on behalf of Noyce that aluminum, or some other material known to be adherent would not be satisfactory for the stated purpose.

It should further be pointed out that the count in question does not require any particular degree of adherence and it would be improper to read into it a requirement that some particular standard of adherence must be met.

Noyce urges that there is nothing in the paragraph relied on in the parent Kilby case to indicate that Kilby had any concern about whether the conducting material would have any adherence at all since there is only the statement that the conducting material be "laid down on the insulating material". This is true only to the extent that Kilby clearly suggested no particular degree of adherence as mentioned above. We think that the clear import of the Kilby disclosure is that the device constructed in the manner taught would be usable under ordinary circumstances and would be expected to withstand normal handling. In our opinion this would necessarily involve at least some degree of adherence, and as pointed out above we believe that one skilled in the art would be led to select a metal for the conductor which would provide such adherence, for example those metals which Dr. Pearson stated were known to be "good stickers". For these reasons we deem it unnecessary to discuss in detail the testimony relative to the adherence of gold films.

In view of the above considerations we are convinced that from the disclosure of Kilby patent '743 one skilled in the art would have no difficulty in selecting an electrically conducting material which would adhere sufficiently well to the silicon oxide layer to satisfy this requirement of count 1.

A third attack made by Noyce on the '743 Kilby patent as support for count 1, is a contention that there is no support for the language,

> * * * said conductor extending from said one contact over said layer across said different portion of the junction * * *.

The contention appears to be that the parent Kilby case does not satisfy 35 U.S.C. 112 as to this matter. Noyce queries how a conductor can be "laid down" making two 90 degree bends as in the conductor between INPUT-2 and plate 51 capacitor C_2, or how would one overcome the difficulty of two crossing conductors 70 between the base contacts 53 and 54 of the respective transistors T_2 and T_1 and the plates 52 and 51 of capacitors C_1 and C_2, or how would one provide the conductor between the GRD terminal and emitter contact 56 of transistor T_1, which apparently runs through space?

These might be valid questions if the present counts were limited to the rather complex structure and circuitry of Figure 6a of the Kilby patent. However, count 1 now before us, as well as other counts, is not so limited but is quite broad and requires only one insulating layer and one conductive film thereon crossing a junction between P-type and N-type regions and would be satisfied if the single conductor 70 interconnecting the emitter contacts 56 were provided by a conductive film on a layer of silicon oxide. Such an arrangement appears to present no particular problems.

It is true that the Kilby '743 patent does not expressly point out, or the drawing distinctly show, where the junction between the P-type and N-type regions is to be found or where is the different portion of that junction which is crossed by the insulating layer and by the "conductor adherent to said layer". However, from a study of the disclosure of that application we have concluded that these features are necessarily implicit therein. The adjacent P-type and N-type regions are clearly the base region 27 and the emitter region under contact 28 in Kilby Figure 4 which illustrates the structure of a transistor element according to the disclosure. The latter region is necessarily formed by the step described at column 6, lines 35-37 of the Kilby patent specification:

> Aluminum was evaporated through a properly shaped mask to provide the transistor emitter areas 56,

which form *rectifying* contacts with the N layer. (Emphasis ours.)

These rectifying contacts satisfy the requirement for a junction between the two specified regions. This junction necessarily surrounds the contact itself although it is not spaced therefrom by any substantial amount, and further, any insulating layer which covers the semiconductor surface up to the contact itself necessarily crosses the junction as does any conductor which is formed on the layer and which reaches the contact. We also think it clear that such crossing of the junction would be at the opening of the C-shaped base contact so that the expression "across said different portion" is satisfied. In other words we are convinced that the Kilby '743 patent provides sufficient disclosure to teach one skilled in the art how to construct on a semiconductive wafer a P-N junction on an insulating layer. And we are further convinced that in following the instructions of that patent the specific structural requirements of the count would necessarily be satisfied. Bloodhart v. Levernier, 20 CCPA 917; 1933 C.D. 260; 64 F2d 367; 17 USPQ 188; and Ackerman v. Light, 25 CCPA 1078; 1938 C.D. 492; 96 F2d 304; 37 USPQ 508. Accordingly, since Noyce took no testimony to establish any date prior to his filing date, Kilby must prevail as to count 1.

Count 2 is generally similar to count and reads as follows:

Count 2

A semiconductor device comprising a body of extrinsic semiconductor having a surface, said body containing adjacent P-type and N-type regions, one overlying the other, with a junction therebetween extending to said surface and there completely encircling said overlying region, the underlying one of said regions extending to said surface and there surrounding said junction, a first metal contact adherent to said surface in ohmic electrical connection with said overlying region, an insulating layer consisting essentially of oxide

of said semiconductor united with said surface and extending across said junction, a metal strip adherent to said layer, said strip being electrically connected to said first contact and extending therefrom over said layer across said junction, and a second metal contact adherent to said surface in ohmic electrical connection with said underlying region, said second contact substantially encircling said junction from one side of said strip to the other.

Noyce urges in addition to the arguments considered above that the two regions specified must be read on regions 25 and 27 and predicates on this assumption an argument that the two ohmic contacts required by this count are not satisfied by contacts 28 and 29 of the Kilby Figure 4.

As we have pointed out above the two regions required by this count are provided on opposite sides of the rectifying junction between aluminum contact 28 and base region 27. Base contact 29 clearly substantially encircles this rectifying junction as required by the count for "said second contact" and the upper portion of the contact 28 necessarily forms an ohmic connection with the overlying region of the rectifying junction since this is the only provision for electrical connection to that region. It therefore satisfies the requirement for "a first metal contact". Kilby must also prevail as to count 2.

As to count 3, the only additional contention advanced by Noyce is that the early Kilby disclosure does not disclose "a dished junction" between P-type and N-type regions as required by this count. He refers to the fact that Kilby admits in his brief that the specific limitations to dished p-n junctions in counts 7, 8 and 9 are not supported by the parent Kilby application and urges that this admission should have included count 3. In his reply brief, Kilby states that counts 7, 8 and 9 specify a plurality of dished p-n junctions while count 3 specified only one. He then

urges that in the mesa transistors of Figure 6a of his parent case the emitter-base junction is a dished junction so that count 3 is supported. We agree with this analysis. As we noted in our discussion of count 1, the rectifying junction between contact 28 and the base region must necessarily surround the contact 28. Moreover as shown in Figure 4 the junction under this contact clearly is convex downward to some degree and therefore is accurately described as dished. In our opinion this is sufficient to satisfy the broad requirement of this count. Accordingly, Kilby must also prevail as to count 3.

Count 4 is similar to count 1 except that the preamble specifies "A diffused junction transistor" while in counts 1, 2 and 3 "A semiconductor device" is specified. Noyce urges that the transistor of Figure 4 of the Kilby patent relied upon is an alloy-junction transistor with a diffused base in which an emitter contact 28 forms a rectifying connection with base 27. He urges that this is not a diffused junction transistor, and further that if the latter term is ambiguous, reference must be made to the Noyce specification to clarify the ambiguity.

We fail to find wherein this broad term is not supported in the prior Kilby patent. In discussing the transistor of Figure 4, at column 5, lines 45 and 46, the specification refers to "a diffused p-n junction 26" which is between the base and collector regions. Noyce has cited no authority for interpreting the term "diffused junction transistor" to require that both junctions be diffused rather than only one. It is true that the Noyce specification describes only transistors in which there are two diffused junctions, however, we find nothing therein which limits the term in question to such transistors. Further, as pointed out by Kilby in his reply brief, in the paragraph commencing at column 5, line 60 of the Kilby patent '743 it is stated that double diffusion may be used to form n-p-n and p-n-p structures. We note also that there is nothing in the structural recita-

tions of count 4 which have significance with respect to a transistor having two diffused junctions rather than one. It is therefore our opinion that Kilby must prevail as to count 4.

Count 5 differs somewhat from the previously considered counts. It reads as follows:

Count 5

> A semiconductor device comprising a single-crystal body of semiconductor material having a surface, said body containing a high-resistivity region and extrinsic P-type and extrinsic N-type regions with a P-N junction therebetween extending to said surface, a metal contact to one of said extrinsic regions adherent to said surface, an insulating layer consisting essentially of oxide of said material on said surface, said layer being congenitally united with said body and extending across said junction, and an electrical connection to said contact comprising a metal strip adherent to said layer, said strip extending from said contact over said layer across said junction, said high-resistivity region underlying a portion of said strip, reducing the shunt capacitance between said strip and said body.

This count specifies in addition to P-type and N-type regions, a high resistivity region, and requires further that this high resistivity region underlies a portion of the metal strip which as discussed in connection with count 1 provides an electrical connection with one of the contacts. The count also states that this arrangement reduces the shunt capacitance between the metal strip and the semiconductor body. Noyce urges that Kilby patent '743 does not disclose this structure.

In his decision on motions the Primary Examiner found support for this feature in the description of Figures 1 and 1a, taken with the description of Figure 6a. The former describes the use of a part of a semiconductor body to form a resistor. However, we do not find therein, or in the

description of Figure 6a, any suggestion that a high resistivity region should underly one of the metal connecting strips on the layer of silicon oxide, much less any indication that such an arrangement decreases the shunt capacitance between the strip and the semiconductor body as required by this count. The Primary Examiner may have considered that the entire wafer body could be regarded as of high resistivity. In our opinion, however, the term "high resistivity" as used in count 5 indicates that the portion in question is of higher resistivity than the remainder of the body or wafer. Otherwise the term would have no significance. In Figure 6a certain portions of the wafer are indicated as resistors, namely R_1, R_2, R_3, R_4, R_5, R_6, R_7 and R_8, but none of these portions underly any of the conductors 70 even approximately.

Accordingly, as to count 5 Kilby is not entitled to the benefit of his prior application, and since the filing date of his involved application is subsequent to that of the Noyce patent, Noyce is entitled to the award of priority as to this count.

Count 6 also includes a feature not involved in counts 1 through 4. Count 6 reads as follows:

Count 6

A semiconductor device comprising a body of semiconductor having a surface, said body containing adjacent P-type and N-type regions, one overlying the other, with a junction therebetween extending to said surface, a first metal contact adherent to said surface in electrical connection to said overlying region, a second metal contact in electrical connection with the underlying one of said regions, an insulating layer consisting essentially of oxide of said semiconductor on said surface, said layer being congenitally united with said body and extending across said junction, an electrical connection to said first contact comprising a metal strip adherent to said layer, said strip extending

from said first contact over said layer across said junction, *and circuit means for applying between said strip and second contact a D.C. voltage of the polarity that reverse-biases said junction, so that said junction acts as a capacitor connected between said strip and said second contact.*

The critical language here is the final clause, emphasized above. The Primary Examiner in finding support for this feature in the Kilby parent case merely referred to certain portions of the specification as applied to counts 1 to 4, without any discussion of the added feature. We are unable to find in the Kilby parent case any suggestion that either of the transistors T_1, T_2 of Figure 6a, be biased as required by the emphasized portion of count 6. Nor do we find any suggestion of this sort in connection with Figure 4, relating to transistors. There is a statement in column 5, lines 25-27 that capacitors produced in the manner of Figure 2 must be properly biased, but Figure 2 does not support the remainder of this count and this cannot be properly read as applying also to the transistor structure of Figures 4 and 6a. For this reason, Kilby is not entitled to the filing date of his parent case as to count 6 and Noyce is entitled to the award of priority as to this count along with counts 5 and 7 through 9.

Priority of invention of the subject matter involved is hereby awarded to Jack S. Kilby, the junior party, as to counts 1, 2, 3 and 4, and to Robert N. Noyce, as to counts 5, 6, 7, 8 and 9, as to which he is senior party.

BOARD OF PATENT INTERFERENCES

George W. Boys
Examiner of Interferences

La Verne Williams
Examiner of Interferences

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Examiner of Interferences

APPENDIX E

Portion of the Decision of the Patent Office Primary Examiner of December 17, 1963

Decision on Motions

1. Party Noyce moves to dissolve under Rule 232(a)(2) on the ground that all the counts are unpatentable to party Kilby because of references which are a statutory bar to this party.

2. Party Noyce moves to dissolve under Rule 232(a)(3) as to counts 5, 6 and 8 on the ground that Kilby has no right to make these counts.

3. Party Kilby moves to strike the five affidavits, filed by Noyce on July 16, 1963, from the record.

* * * * * * * * * *

As to the issue of the counts being disclosed in Kilby's parent applications, attention is directed to application 791,602. Note particularly the portion from page 11, line 23 to page 13, line 17. [Col. 6, lines 4-68] Note Figs. 6-7, specifically Fig. 6a, and lines 6 through 17 on page 13 [col. 6, lines 56-68] where the structure of the semiconductor that is represented in Figs. 6 through 7 is described. A silicon oxide insulating layer is described as covering the wafer and on selected portions between points of electrical connections. Electrical conducting material such as gold may be laid down on the insulating material making the connections in place of wires 70. This portion of this application, (pages 11 to 13 [Col. 5, line 55 to Col. 7, line 9] together with the figures), are sufficient disclosure for the structure recited in counts 1 through 4. The passage beginning at page 7, line 18 to page 9, line 4, [Col. 4, lines 9-64] together with this same portion of pages 11 to 13 fully supports count 5. Count 6 has support in the pages and figures indicated in the discussion of counts 1 to 4. Page 12, line 14 [Col. 6, line 29] and following to page 13, lines 8 to 17 [Col. 6, lines 58-68] and Figs. 6a-6b disclose the structure recited.

* * * * * * * * * *

Summary

1. Kilby's motion to strike is granted.

2. Noyce's motion to dissolve because counts are unpatentable to Kilby is denied.

3. Noyce's motion to dissolve as to counts 5, 6 and 8 because Kilby has no right to make these counts is denied.

4. No appeal (244(d)).

G. N. WESTBY
Examiner

[Note: The original page and line references are to the typewritten Kilby application 791,602 as filed. For the convenience of the Court, the corresponding column and line references to the printed Kilby patent No. 3,138,743 [R. 103] are shown within brackets].